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(54) IMAGE PICKUP DEVICE
(11) 3-70274 (A) (43) 26.3.1991 (19) JP
(21) Appl. No. 64-206158 (22) 9.8.1989
(71) SANYO ELECTRIC CO LTD (72) MOTOAKI ASAO
(51) Int. Cl⁵. H04N5/238

PURPOSE: To easily obtain a video special effect such as automatic rear light correction, mask and fade-in by providing a liquid crystal panel arranged between a lens system and an image pickup means and having plural picture elements whose optical transmission rate is controlled independently.

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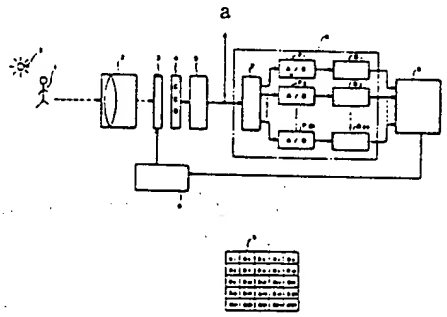

a: image pickup video signal, 5: signal processing, 7: selection, Q_1-Q_{25}: digital integration

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⑤4発明の名称　撮像装置

⑳特　願　平1−206158

㉒出　願　平1(1989)8月9日

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明　細　書

1. 発明の名称

撮　像　装　置

2. 特許請求の範囲

(1) 光を集光し撮像素子上に結像させるレンズ系と、

結像された像を撮像して撮像映像信号を出力する撮像手段と、

前記レンズ系と前記撮像手段間に配され、光透過率が独立に制御可能な複数の画素を有する液晶パネルを備える撮像装置。

(2) 前記液晶パネルの画素を前記撮像素子の画素に対応させ、前記撮像素子の画素の各撮像出力レベルに応じて前記液晶パネルの対応する画素の光透過率を制御することを特徴とする請求項1記載の撮像装置。

3. 発明の詳細な説明

(イ) 産業上の利用分野

本発明は、入射光量調整機構付きのビデオカメラ等の撮像装置に関する。

(ロ) 従来の技術

通常のビデオカメラでは、太陽下や室内等撮像環境に応じて被写体照度が様々に変化しても、撮像素子への入射光量を常に一定に保ち、撮像映像信号の輝度レベルが極端に高いあるいは低い状態を回避するためにメカ的な絞り機構が配されている。このメカ的な絞り機構は、数枚の羽根と、この羽根の開閉機構により構成されるため、絞り機構自体が小型化に適さず、構成部品点数が多く、また消費電力も大きくなるというメカ式であることによる独特の欠点を有していた。

そこで、特開昭62−169587号公報(H04N5/238)では、メカ的な絞り機構を用いず、撮像素子の前方に液晶パネルを配設し、この液晶パネルの光透過率を電気的に制御することにより、入射光量の調整を行う一例が提案されている。

前記従来技術では、撮像素子にて得られる撮像映像信号の一画面分を該一画面分の映像信号レベルとして積分し、この積分値が常に一定となる様

に液晶パネルのパネル全体の光透過率を一律に制御して入射光量調整を図っている。

（ハ） 発明が解決しようとする課題

前記従来技術によれば、液晶パネルは所謂「べた電極」であり、光透過率は常にパネル全体で変化することになり、液晶パネルの任意の部分の光透過率のみ部分的に変化されることは不可能であった。従って、被写体に部分的に異常に高輝度な部分が存在すると光透過率はパネル全面にわたって小さくなり、異常輝度部分以外の部分が著しく暗い画面となってしまう。即ち、所謂「逆光補正」ができないという欠点があった。

（ニ） 課題を解決するための手段

本発明は、レンズ系と撮像素子間に配された光量調整用の液晶パネルの各画素の光透過率を夫々独立に変化させることを特徴とし、特にこれらの画素を撮像素子の画素に対応させ、この撮像素子の画素の各撮像出力レベルに応じて液晶パネルの対応する各画素の光透過率を制御することを特徴とする。

（ホ） 作 用

本発明は上述の如く構成したので、撮像画面の任意の部分の絞りが制御可能であり、特に逆光補正効果を得ることができる。

（ヘ） 実施例

以下、図面に従い本発明の実施例について説明する。

第１図は第１実施例のビデオカメラの回路ブロック図である。

被写体（１）から出た光は、レンズ系（２）に入射されて集光され、液晶パネル（３）を通って固体撮像素子（ＣＣＤ）（４）上に結像される。この結像された像は、ＣＣＤ（４）にて光電変換されて読み出され、信号処理回路（５）にて撮像映像信号に変換されて後段のＡ／Ｄ変換器及びディジタル積分器と共に輝度レベル検出回路（６）を構成する選択回路（７）に供給される。

選択回路（７）は、第２図の如く撮像画面をＭ×Ｎ（第２図ではＭ＝Ｎ＝５）の複数の領域(A1)(A2)-(A25)に分割して、この各領域内での撮像映像信号を時分割的に抜き取り、後段のＡ／Ｄ変換器(P1)(P2)-(P25)に出力する。従って、Ａ／Ｄ変換器(P1)には領域(A1)内の撮像映像信号が、同様にＡ／Ｄ変換器(P2)(P3)-には夫々領域(A2)(A3)-内の撮像映像信号が供給され、各Ａ／Ｄ変換器は所定のサンプリング周期にてこの映像信号をＡ／Ｄ変換し、このＡ／Ｄ変換値が後段のディジタル積分器(Q1)(Q2)-(Q25)にて１フィールド期間にわたって積算され、各領域内の撮像映像信号の１フィールド分がディジタル積分されることになり、この積分値が各領域の輝度レベルとして制御信号作成回路（８）に出力される。

液晶パネル（３）は複数の画素（最小単位）にて構成され、これらの画素の所定個の集合体を１つのブロックとして、このブロックを撮像画面の１つの領域に対応させることにより、液晶パネル（３）も第３図の如く５×５の２５個のブロック(B1)(B2)-(B25)が設定され、しかも各画素は液晶パネル駆動回路（９）の駆動信号にて駆動され、その光透過率が夫々独立に制御される。

制御信号作成回路（８）は各領域の輝度レベルに基づいて、液晶パネル（３）の各画素の光透過率を制御する液晶パネル制御信号を作成するものである。ここで、同一ブロック内に存在する複数の画素については、全て同一の光透過率となる様に制御信号が発せられる。更に詳述すると、輝度レベルが高い領域ほど、この領域に対応するブロックの光透過率を小さくする様な制御信号が発せられる。

液晶パネル駆動回路（９）は、前記制御信号を受けて、各画素に対して制御信号にて指定される光透過率を実現する駆動信号を液晶パネル（３）に供給する。

次に具体的に液晶パネル（３）による光量調整動作について説明する。

第４図の如き逆光状態の撮像画面を考慮した場合、即ち異常高輝度部である太陽（Ｓ）が領域(A7)に入り込んだ場合、領域(A7)の輝度レベルは著しく高く、次いでこの周囲の領域(A1)(A2)(A3)(A6)(A8)(A11)(A12)(A13)の輝度レベルが比較的高く

なる。そこで、領域(A7)に対応するブロック(B7)の光透過率を極端に小さくし、領域(A1)(A2)(A3)(A6)(A8)(A11)(A12)(A13)に対応するブロック(B1)(B2)(B3)(B6)(B8)(B11)(B12)(B13)の光透過率を若干小さくし、その他の領域に対応するブロックの光透過率を大きく維持する様な制御信号が制御信号作成回路(8)より発せられる。この制御信号に基いて液晶パネル(3)が駆動し、第5図の如くブロック(B7)の光透過率が極端に低く、ブロック(B1)(B2)(B3)(B6)(B8)(B11)(B12)(B13)の光透過率が若干低くなって太陽からの入射光量が抑えられ、主要被写体(1)にとっての逆光補正が為される。

上述の実施例では、液晶パネル(3)は予め複数の画素の集合体であるブロックにて分割され、撮像画面の輝度分布に応じてブロック毎の光透過率を制御する様に構成したが、第6図の如くブロックを設定せずに画素単位で光透過率を制御することも可能である。第6図の第2実施例では、撮像画面に設定された領域の個々の大きさを極端に小さくし、その個数を液晶パネル(3)の全画素数と一致させて、領域と画素を1：1に対応させている。

そして輝度レベル検出回路(10)は第1図と同様に選択回路と複数のA／D変換器及びディジタル積分器により構成されて、上述の如く細分化された領域毎の輝度レベルが制御信号作成回路(11)に入力される。

制御信号作成回路(11)は、液晶パネル(3)の各画素の光透過率を、これらの画素に1：1に対応する各領域の輝度レベルに応じて制御し、輝度レベルが高くなる程に対応する各画素の光透過率を低くして逆光補正を為す。

この様に光透過率をブロック毎に一律に変化させる第1実施例に比べ、画素単位で変化させられる第2実施例では、より木目の細かい逆光補正が可能となる。

次に液晶パネルの各々の画素が独立にその透過率を制御できる点を利用して、撮像画面に様々な特殊効果を持たせる第7図の第3実施例について説明する。この第3実施例は逆光補正を目的とするものではないので、液晶パネルの光透過率の制御信号を撮像映像信号から作成するのではなく、パターン発生回路(20)にて作成することを特徴とする。即ち、パターン発生回路(20)では、撮像画面のどの領域の輝度レベルをどの程度上昇あるいは降下させるかを撮像画面パターン上に具体的に指定し、これに応じて領域に対応する画素の光透過率が決定されて制御信号が作成される。例えば、撮像画面のある任意の部分以外の光透過率を降下させることにより、任意の部分のみが窓が開いた様な、即ちこの任意の部分を除く部分だけがマスクがかかった様な効果を出すことができる。また、パターン発生回路(20)にて各領域の光透過率を時間的に変化させることによりフェードイン、フェードアウト効果を出したり、幕が開いたり閉じたりするワイプ効果を出すことが可能となる。

尚、前記第1あるいは第2実施例の構成を用いれば、従来例（特開昭62－169587号）に示される様に映像信号を積分して、その結果により液晶パネル全体の光透過率を均一に制御したり、映像信号の特定の領域に着目し、その部分の光量によって液晶パネル全体の透過率を均一に制御する構成も勿論可能である。また、上述の各実施例の構成を適時切り換えて使用する事も可能である。

更に、ＣＣＤに代えて撮像管を用いたカメラシステムに本発明を用いた場合には、撮像管の焼き付け防止の効果も得られる。

（ト） 発明の効果

上述の如く本発明によれば、液晶パネルを配設する簡単な構成により、自動逆光補正やマスク、フェードイン等の映像特殊効果を得ることが容易に可能となる。

4. 図面の簡単な説明

第1図乃至第5図は本発明の第1実施例に係り、第1図は回路ブロック図、第2図、第3図は領域及びブロックの設定説明図、第4図は撮像画面を示す図、第5図は光透過率の変化を示す図で

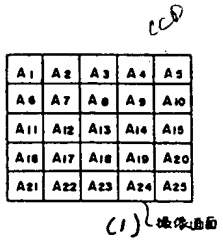
ある。また、第６図は本発明の第２実施例の回路ブロック図、第７図は第３実施例の回路ブロック図である。

（２）…レンズ系、（４）…ＣＣＤ、（３）…液晶パネル

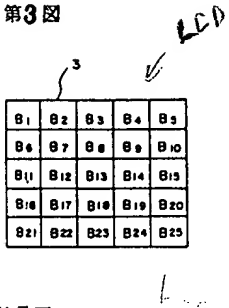
出願人　三洋電機株式会社

代理人　弁理士　西　野　卓　嗣（外２名）

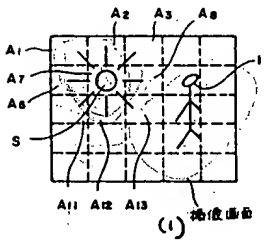
第2図



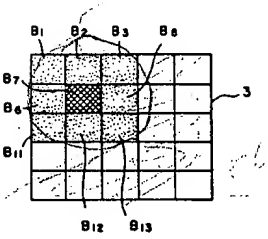
第3図



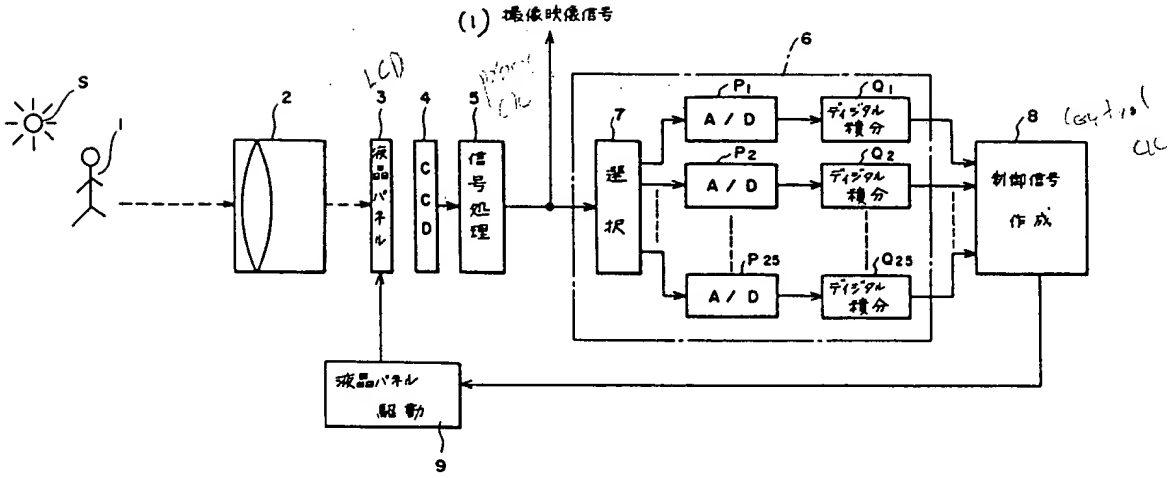
第4図



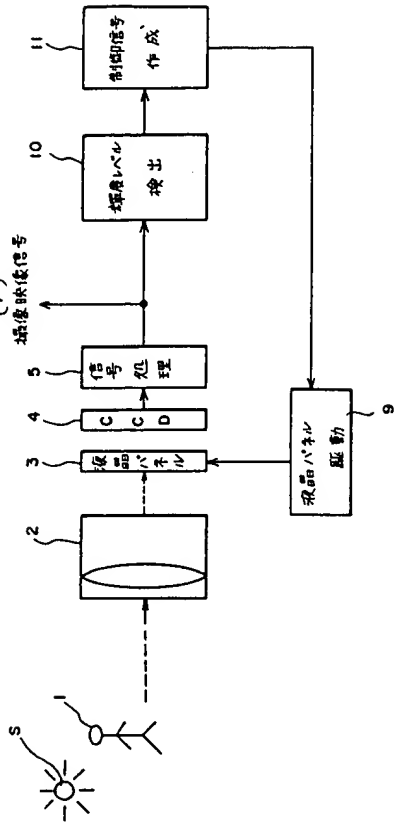
第5図



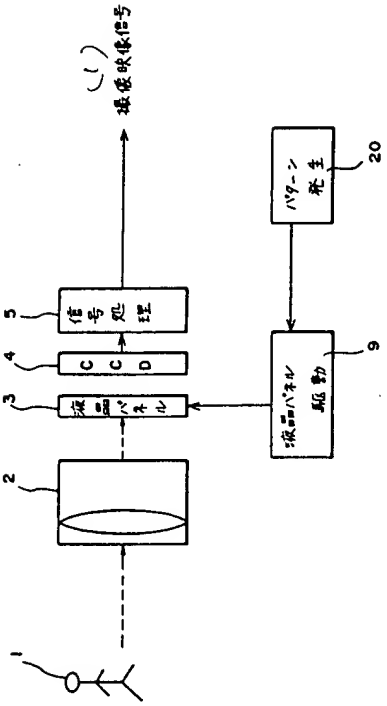
第1図



第6図


11
制御信号作成
10
輝度レベル検出
(1)
撮像映像信号
5
信号処理
4
CCD
3
液晶パネル
液晶パネル駆動
9
2
1
S

第7図


(1)
撮像映像信号
5
信号処理
4
CCD
3
液晶パネル
液晶パネル駆動
9
パターン発生
20
2
1

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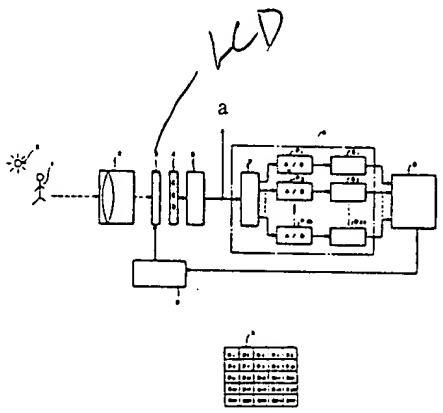

a: image pickup video signal, b: signal processing, 7: selection, Q_1-Q_{25}: digital integration

Japanese Kokai Patent Publication No. H3-070274, published March 26, 1991; application No. H1-206158, filed August 9, 1989; inventor, Motoaki Asao; assignee, Sanyo Denki KK

IMAGE PICKUP DEVICE

2. Claims

1) An image pickup device that provides a lens system which forms an image on an image pickup element by focusing light; an image pickup which send an image-pickup picture signal by picking up the formed image; and a liquid crystal panel which has several picture elements arranged between the lens system and the image pickup and the light permeability of which are independently controlled.

2) The image pickup device mentioned in claim 1 wherein the picture element of the liquid crystal panel corresponds to the image element of the image pickup element. The light permeability of the picture element corresponding to the liquid crystal panel is controlled according to each image pickup output level of the picture element of the image pickup element.

3. Detailed Description of the Invention

[A. Field for Industrial Application]

This invention concerns an image pickup device (e.g., video camera, etc.) with an adjusting mechanism for the amount of incident light.

[B. Existing Technology]

With a common video camera, because the lighting of the

subject to be copied changes according to the environment (e.g., outdoors or indoors, etc.), a mechanical iris system is arranged to constantly maintain the amount of incident light to the image pickup element and to avoid the extremely high or low levels of brightness of the image-pickup picture system. This mechanical iris system is made of several "feathers" and a mechanism that opens and closes these feathers. Therefore, the iris system itself is not suitable for miniaturization. It also has a large number of structural parts. Moreover, there is considerably high electric power consumption.

An example has been proposed in Japanese Kokai Patent Publication No. 62-169587 (H04N5/238). A liquid crystal panel is arranged in front of the image pickup element and the adjustment in the amount of incident light can be performed.

With the above mentioned existing technology, one portion of the image-pickup picture signal level obtained by the image pickup element is integrated as the image signal level of the picture portion. The light permeability of the entire panel of the liquid crystal panel is uniformly controlled so as to constantly be a fixed integrated value. The adjustment of the amount of incident light is then effected.

[C. Problems which the Invention Attempts to Resolve]

With the existing technology, the liquid crystal panel is a so-called sticky (sic) electrode and the light permeability is constantly changed by the entire panel. Therefore, it is impossible to effect a partial change of only the light

permeability at an optional section of liquid crystal panel. Consequently, when there is a partial abnormally high brightness section on the image to be copied, the light permeability is reduced over the entire surface of the panel. Therefore, the section other than abnormally bright section becomes a greatly dark picture. More specifically, so-called reverse light correction cannot be conducted.

[D. Means for Resolving Problems]

This invention changes the light permeability of each picture element of the liquid crystal panel by an amount of light adjustment independently arranged between the lens system and the image-pickup element. These picture elements correspond to the picture element of the image-pickup element and the light permeability of each picture element corresponds to the liquid crystal panel. Control is according to each image-pickup output level of the picture element of this image-pickup element.

[E. Action]

This invention is constructed as mentioned above. Therefore, the iris of optional sections of the image-pickup picture surface can be controlled and a reverse light correction effect can be obtained.

[F. Practical Example]

Examples of this invention are explained below with reference to the accompanying drawings.

Figure 1 is a circuit block view of a video camera.

Light is emitted from the subject to be copied (1) and is

focused by incidence to a lens system (2). It is image-formed on a solid image-pickup element (CCD) through a light crystal panel (3). This image is converted photoelectrically by the CCD (4) and is converted to an image-pickup picture signal at a signal processing circuit (5). It is then sent to a selection circuit (7) which forms a brightness level detection circuit (6) with a post-stage A/D converter and a digital integrator.

The selection circuit (7) extracts with time division the image-pickup picture signal in each region by dividing the image-pickup picture, as shown in Figure 2, into several regions (A1), (A2)... (A25) of M x N (in Figure 2, M = N = 5) and sends the signal to the post stage A/D converters (P1), (P2).... (P25). The image-pickup picture signal inside of the region (A1) is sent to the A/D converter (P1), and the image-pickup picture signal inside of each of the regions (A2) (A3) is sent to the A/D converters (P2) (P3), respectively. Each A/D converter converts the picture signal to A/D by a specific sampling cycle. This A/D conversion value is integrated in a single field period at the post-stage digital integrators (Q1) (Q2).. (Q25). The single field portion of the image pickup picture signal in each region is then digitally integrated. This integrated value is then sent to the control signal formation circuit (8) as the brightness level of each region.

The liquid crystal panel (3) is comprised of several picture elements (minimal unit). The integrated body of these specific picture elements is used as one block and by having this block

correspond to one region of the image-pickup picture surface, as shown in Figure 3, twenty-five 5 x 5 blocks (B1) (B2).. (B25) are set on the liquid crystal panel (3). Moreover, each picture element is driven by the driving signal of the liquid-crystal panel driving circuit (9) and the light permeability of each is respectively independently controlled.

The control signal formation circuit (8) forms a liquid crystal panel control signal which controls the light permeability of each picture element of the liquid crystal panel (3) based on the brightness level of each region. Here, a control signal is generated so that the light permeability is the same in all of the several picture elements existing in the same block. Furthermore, the control signal reduces the light permeability of a corresponding block when this brightness level is in a higher region.

The liquid crystal panel driving circuit (9) receives the control signal and supplies the driving signal which effects the light permeability assigned by the control signal to each picture element.

The amount of light adjustment action by the liquid crystal panel (3) is explained in detail below.

As shown in Figure 4, consideration is given to the image-pickup picture surface of reverse-light conditions. More specifically, when the sun (S) with abnormally high brightness enters the region (A7), the brightness level of the region (A7) is quite high. The brightness levels of the periphery of the regions

(A1), (A2), (A6), (A8), (A11), (A12) and (A13) become comparatively high. Thus, a control signal is generated by the control signal formation circuit (8) so as to greatly reduce and maintain the light permeability of the block (B7) which corresponds to the region (A7). The light permeability of the blocks (B1), (B2), (B3), (B6), (B8), (B11), (B12) and (B13) which correspond to the regions (A1), (2), (A3), (A6), (A8), (A11), (12) and (A13) is made slightly smaller as is the light permeability of block corresponding to the regions other than above mentioned regions.

The liquid crystal panel (3) drive based on this control signal and the light permeability of the block (B7), as shown in Figure 5, becomes extremely low while the light permeability of the blocks (B1), (B2), (B3), (B6), (B8), (B11), (B12) and (B13) becomes slightly low. The amount of light incidence from the sun is then controlled and the reverse-light correction of the important subject to be copied is then conducted.

With the above mentioned example, the liquid crystal panel (3) is made by pre-dividing into blocks the integrated body of several picture elements so as to control the light permeability of each block corresponding to the brightness distribution of the image pickup picture surface. However, the light permeability can be controlled by the picture element unit without setting the block as shown in Figure 6.

In the second example in Figure 6, each region set on the image-pickup picture surface is made very small. The numbers match the number of picture elements of the liquid crystal panel

(3). The region and the picture element then correspond 1:1.

The brightness level detection circuit (10) is comprised of the same selection circuit, several A/D converters and digital integrator as in Figure 1. The brightness level of each region which is finely divided as explained above is sent to the control signal formation circuit (11).

This control signal formation circuit (11) controls the light permeability of each picture element of the liquid crystal panel (3) according to the brightness level of each region which corresponds 1:1 to these picture elements and lowers the light permeability of each picture element which corresponds to the higher the brightness level. Reverse light correction is then conducted.

In comparison to the first example which uniformly changes the light permeability at each block, finer reverse light correction is possible with the second example which changes the light permeability of picture element unit.

A third example in Figure 7 is explained below and shows how the light permeability of each picture element of the liquid crystal panel can be controlled independently. The objective of this third example is reverse light correction. Therefore, the signal to control the light permeability of the liquid crystal panel is not formed from the image-pickup picture signal, but rather is formed by a pattern generation circuit (20). More specifically, whether or not the brightness level of whatever region on the image-pickup picture surface either rises or falls on

the image-pickup picture surface pattern is specifically assigned by the pattern generation circuit (20). According to this specific assignment, the light permeability of picture element that corresponds to the region is then decided and a control signal is formed. As an example is a window open only at an optional section. More specifically, an effect that masks only a section except for the optional section can be created by decreasing the light permeability other than a certain optional section of the image-pickup picture surface. By changing the light permeability of each region in a timely way by the pattern generation circuit (20), a feed-in/feed-out effect may be created or a wipe effect which opens and closes the curtain can be created.

Moreover, by using the structure of either the first or second example, the image formation signal described in the existing example (Japanese Kokai Patent Publication No. 62-169587) is integrated and the light permeability of the entire liquid crystal panel is uniformly controlled as a result. By paying attention to a specific region of the image formation signal, the permeability of entire liquid crystal panel is uniformly controlled by the amount of light of its section. Moreover, it is possible to use by the timely switching of the formation of each of the above examples.

When this invention is applied to a camera system that uses a picture tube instead of the CCD, picture tube burning can be prevented.

[G. Effect of the Invention]

With this invention, as explained above, the liquid crystal panel is simply formed. Therefore, specific image formation effects (e.g., automatic reverse light correction, masking, feed-in, etc.) are easily obtained.

4. Simple Explanation of Drawings

Figures 1 through 5 are a first example of this invention. Figure 1 is a circuit block view. Figures 2 and 3 are diagrams of fourth regions and blocks. Figure 4 shows the image-pickup picture surface. Figure 5 shown the change of light permeability. Figure 6 is a circuit block view of the second example of this invention. Figure 7 is a circuit block view of the third example of this invention.

2... lens system

4... CCD

3... liquid crystal panel

In Figures 2 and 4: (1) is an image pickup picture surface.

In Figures 1, 6 and 7: (1) is an image pickup picture formation signal.

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